

EFFECT OF REPEATED VERBAL STIMULATION UPON A FLEXOR-EXTENSOR RELATIONSHIP*

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The present study is an extension of the work of one of us (D.E.C.) (2, 3, 4) who has been investigating the effects of repeated verbal stimulation upon the behavior of psychiatric patients under treatment. From clinical observations it appears that transitory personality changes (e.g. increased assertiveness) may occur in a patient who listens to a statement (e.g. that he will become more assertive) presented to him through a speaker installed in his room. Such observations raised certain questions concerning the range of phenomena which could be affected by verbal stimulation, excluding hypnosis.

One question which occurred to us was whether repeated verbal stimulation would have any measurable effect upon physiological function. In addition to our interest in the question of the effect of verbal stimulation upon bodily function, we considered that the possibilities of objective measurement afforded by the physiological methods might prove a useful (though indirect) check on the clinical observations. Therefore, it seemed an excellent opportunity — in those patients who were undergoing repeated verbal stimulation for therapeutic purposes — to devote part of the day to procedures designed to provide an answer to the following question: Can repeated verbal stimulation produce an objectively measurable effect upon a physiological state? The purpose of the present paper is to describe an exploratory investigation of this question. As the physiological state to study we chose the reciprocal relationship between extensor and flexor tension in the muscles of the upper arm. Although patients whom we studied with physiological methods, also, of course, underwent therapeutic verbal stimulation, we shall confine the present report to physiological data.

Subjects

Procedure

Four female subjects, all psychiatric patients on the service of one of us (D.E.C.), were employed in the present experiment. Age for each patient was as follows: C.S., 32, M.P., 37, A.W., 56, and C.L., 35. All four patients were chronic psychoneurotics whose cooperation in the laboratory was satisfactory for accurate measurement of muscle tension, in all instances.

Repeated verbal stimulation

General considerations. Although space does not permit full exposition of the theoretical notions underlying the procedures designed to increase the effectiveness of repeated verbal stimulation in this program of investigation (2, 3, 4), the ones chiefly relied on, and the underlying rationale in each case, are briefly sketched as follows: (a) Intensive electroshock is administered prior to verbal stimulation in most cases on the hypothesis that the effectiveness of the verbal stimulation may be increased following disruption of ongoing patterns, of behaviour. (b) Although it is not possible to apply the conditions as rigorously as in the case of the McGill experiments with normal subjects, when feasible verbal stimulation is carried out under conditions of partial sensory deprivation, using the McGill technique (1). The purpose here is to limit, as far as possible, inter-

*This study was supported in part by a grant from the Society for the Investigation of Human Ecology.

¹We wish to acknowledge with gratitude the assistance of Mr. L. Rubenstein who prepared the sound tapes and the mechanisms for playing them to the patients.

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fering effects of environmental stimulation, and thereby to increase the effectiveness of the voice heard through the speakers. (c) An attempt is made to counteract adaptation to stimulation, by introducing variations into the way the statement is presented to the patient. In preparing the tape different tones of voice and shifts in emphasis from one word to another are intentionally introduced. In addition, novel effects are produced by arranging a multiplicity of speakers in the room so that the voice appears to change in intensity from minute to minute and to come from different locations.

In the present investigation, six hours each day were devoted to verbal stimulation for the purpose of changing behavior patterns of the individual, and six hours to the statement concerning extension of the arm which, as mentioned, is the sole concern of the present paper.

Repeated verbal stimulation in the present study. The following statement was repeatedly presented to all subjects: "Your right arm is straightening out. Your right arm feels as if you are reaching out for something. Your right arm feels stiff at the elbow as it does when you are stretching." A tape was prepared with this statement made in a very clear, forceful voice which varied in tone and accentuation as the same statement was repeated in several different ways (the words were always the same, but the intonations differed). This tape was then played over and over again to the subject in her own room for approximately six hours per day. The number of hours of presentation were approximately as follows: C.S., 18, M.P., 90, A.W., 88, and C.L., 24.

Subject M.P. was sedated with various drugs which kept her in a partially somnolent state for a considerable portion of the time, although she heard the tape under conditions of waking between periods of sleep. In three of the four cases, the tape was played through the speakers in the patient's room. A.W. received her stimulation in a different setting: a speaker underneath her pillow stimulated her with the statement concerning her arm approximately six hours per day.

Electromyographic recording procedure

The subject was seated in a comfortable chair with the right arm placed in a comfortable position on a pillow, resting in her lap. The right hand rested palm down on the pillow, two inches from a fixed attachment to the arm of the chair. The elbow was positioned with reference to a sponge-rubber attachment, so that the angle which the subject's arm made with the arm of the chair was approximately 75 degrees. Extreme caution was exercised in placing the arm always in the same position. The subject was asked to relax as much as possible, and was instructed not to move nor talk during the recording.

Standard cellulose leads were employed for recording electromyograms (EMGs) from forehead, biceps, and triceps muscles (5). The forehead electrodes were placed chiefly to distract the subject's attention from focusing entirely on the arm, and the results from such recording will not be considered in this paper.

The first step in the experiment was that of making simultaneous recordings from biceps and triceps, before the application of repeated verbal stimulation. The subject was asked to relax as much as possible, and after muscle tension appeared to reach a plateau of relaxation, a recording, approximately ten minutes in duration, was taken. The data to be reported were those from the part of the electromyographic record showing the highest degree of relaxation for each particular patient.

Prestimulation tracings were taken from all patients. No tracings were

TABLE 1: EFFECT OF REPEATED VERBAL STIMULATION ON FLEXOR-EXTENSOR DOMINANCE

Subject	Date 1956	Mean ^a		Grand Mean		Dif.	Prob.
		Prestim.	Poststim.	Prestim.	Poststim.		
C.S.	4 Apr.	2.27					
	24 "	11.32					
	27 "		-3.19				
	1 May		2.60				
	4 "		-2.93				
M.P.	18 May	-0.68					
	20 June		-0.75				
	29 "		-4.67				
	11 July		0.32	-0.68	-1.58	0.90	< .001
A.W.	30 May	6.46					
	21 June		-53.62				
	3 July		23.12				
	11 "		-3.58	6.46	-12.06	18.52	< .001
C.L.	24 July	2.14					
	27 "	9.85					
	3 Aug.		0.16	5.42	0.16	5.26	< .001

^aBiceps tension in microvolts minus triceps tension in microvolts. Note that minus values indicate extensor dominance.

taken during the period that the patients were undergoing repeated verbal stimulation. Patients were brought down to the laboratory for the first post-stimulation tracing very soon after the final termination of stimulation. For example, in the case of C.S., prestimulation recording was made on 24 April, stimulations were presented on 25, 26, and 27 April, and the first post-stimulation recording was made on the afternoon of 27 April, following termination of stimulation at noon.

Every possible attempt was made to avoid having the patient make any association between the verbal stimulation and the tracings which we made. We believe that we were successful in concealing this association, inasmuch as no patient at any time during the experiment ever made any remarks to those taking the EMGs that would indicate that she had made the connection between the verbal stimulations and these laboratory procedures.

Treatment of data

The section of tracing selected for measurement in each instance was approximately ten minutes in duration, and from the part of the session when the subject was most relaxed. An integrator recorder was used to simplify measurement. Primary tracings were taken throughout for purposes of monitoring the integrated record. For the first three subjects an integration rate of 2-per sec. was used, and for the fourth subject a rate of one per 4-sec. Integrator deflections were measured in pairs. That is, the deflection from biceps, and the deflection directly opposite from it, that for triceps, constituted a pair of measurements of muscle tension, recorded simultaneously. The difference between the deflections in each pair (converted to microvolts from our calibrations) constituted our primary data. The subtraction was always made in the direction of biceps minus triceps, so that flexor (biceps) dominance was indicated by positive values, and extensor dominance was indicated by minus values. The mean values in Table I were obtained in this manner.

Results

Figure 1 illustrates (with primary tracings) the reversal in direction of flexor-extensor dominance which was observed in the present experiment, when we compared tracings which were obtained before and after repeated verbal stimulation. Table 1 summarizes the data from the experiment. First note the combined data on the right side of the table. Observe that in each case, values following repeated verbal stimulation showed a significant increase in the direction of extensor dominance. Probabilities are based on critical ratios.

On the left side of the table, a more detailed breakdown of the data indicates that in all four cases, the first poststimulation recordings showed a change, from the prestimulation condition, in the direction of greater extensor tension.

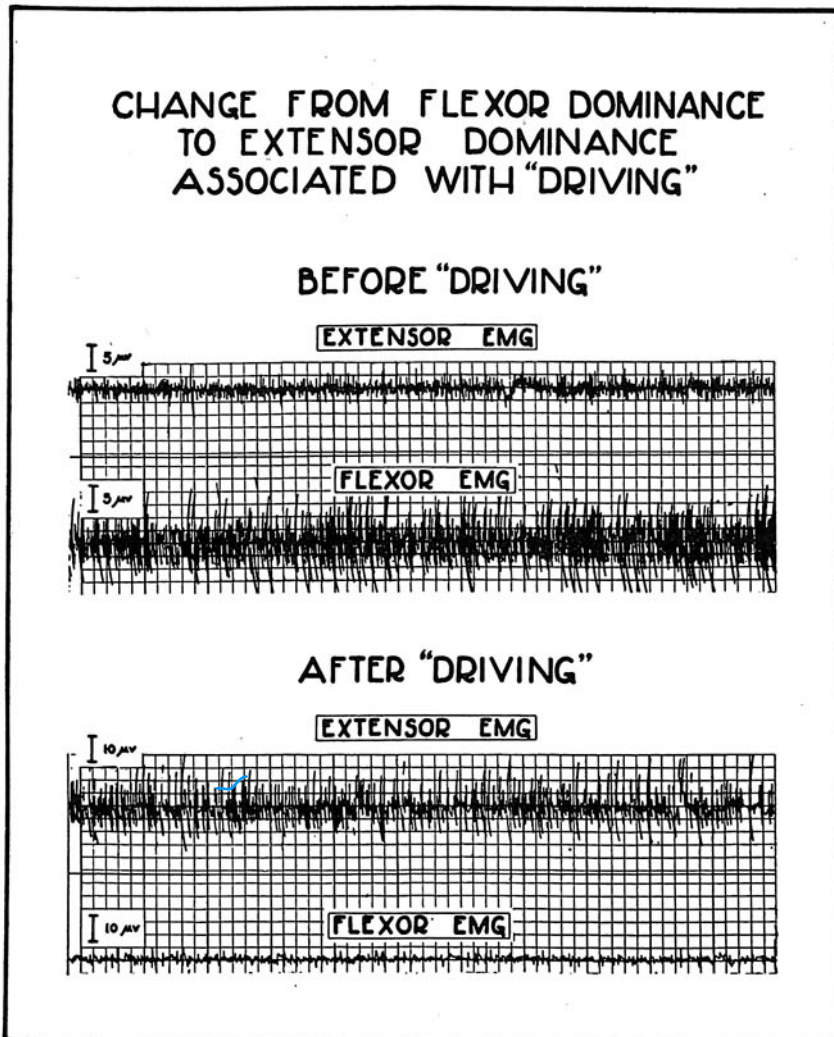


Fig. 1. Comparison of flexor-extensor relationship before and after repeated verbal stimulation in C.S. Flexor and extensor muscles were biceps and triceps of the right arm. Records were taken under conditions of relaxation with the arm comfortably postured in standard position. The section of tracings chosen for illustration represents approximately 11 sec. of recording. "Driving" is a brief designation for repeated verbal stimulation.

Of the three cases with several poststimulation recordings, two showed the highest negative value (i.e. extensor dominance) on the first recording, and the third patient (M.P.) showed minus values on the first and second poststimulation recordings and a positive value on the last. It is, of course, difficult to determine the duration of the effects of repeated verbal stimulation, but from the data of C.S., particularly, it seems reasonable to suggest that the effects may endure up to three weeks.

It may be of interest to note that effect of electroconvulsive therapy appears to be in the direction of increasing flexor dominance, as we have measured it. C.S. and C.L. whose prestimulation recordings were taken at different stages of ECT showed a significant rise in the positive values (see Table 1) associated with this treatment.

Discussion

Present results suggest that repeated verbal stimulation may be effective in altering a flexor-extensor relationship. It is important to consider whether present results may have been produced by our subjects' consciously tensing their triceps muscles during the recording. From our observations, this explanation of our findings appears very unlikely. As mentioned, no subject seemed to associate our recordings with the verbal stimulation which she had been receiving. One of us (R.B.M.) sat with the patient through all sessions, and never observed any sign of tension in the arm which rested quietly in her lap. Very complete relaxation was achieved, with all patients showing extremely low microvolt readings (down to 1.5-2.0 microvolts, at times). In one case, at least, it seems reasonable to entirely rule out the possibility of voluntary effort. C.S. in her first poststimulation session was considerably regressed from a massive course of ECT. She would not respond at all to questions, and about the only communication possible was through a smile, which she would return in a very infantile way. We can be very certain that this patient did not tense her arm to produce a record of extensor dominance.

From present findings, it appears reasonable to conclude that prior verbal stimulation may be effective in changing the reciprocal relationship between flexor tension and extensor tension in an arm at rest, in the absence of any voluntary effort on the part of the subject at the time of electromyographic recording. It would be very hazardous at the present time to guess how this change might occur. However, present findings are encouraging with respect to further attempts to objectively measure the effectiveness of repeated verbal stimulation upon physiological function. Moreover, the suggestion from present results that physiological states, not readily accessible to conscious voluntary control, may be altered by verbal means, raises some provocative questions concerning the field of psychosomatic medicine.

Summary

Previous work with psychiatric patients has indicated that repeated verbal stimulation, without induction of hypnotic trance, may produce definite — though transitory — personality changes. The purpose of the present investigation was to determine whether such repeated verbal stimulation would affect an objectively measurable physiological state.

Accordingly, we chose to study flexor-extensor (biceps-triceps) dominance of the right upper arm. Several means designed to increase the effectiveness of repeated verbal stimulation were employed. Prior to verbal stimulation, electromyographic recordings were carried out in order to determine the amount and direction of dominance in the flexor-extensor relationship. In three of four

patients, the prestimulation recordings revealed flexor dominance with only slight extensor dominance in the fourth patient. In all four cases a recorded statement to the effect that the right arm was extending was played repeatedly to the patient.

Results showed that in all four cases there was a statistically significant shift in the direction of greater extensor dominance.

Evidence was cited favoring the conclusion that the positive effects of repeated verbal stimulation were not simply produced by voluntary muscular contraction or posturing on the part of the patients. The relevance of present findings to problems in the field of psychosomatic medicine is suggested.

References

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Résumé

L'expérience antérieure démontre que, chez les patients psychiatriques, des modifications certaines de la personnalité, bien que transitoires, peuvent être produites par la stimulation verbale répétée, sans induire une transe hypnotique. Le but de la présente recherche était de déterminer si une telle stimulation verbale répétée affecterait un état physiologique objectivement dosable.

A cet effet, nous avons choisi pour notre étude la prédominance fléchisseur sur extenseur (biceps-triceps) au bras droit. Divers moyens d'augmenter l'efficacité de la stimulation répétée furent employés. Avant la stimulation verbale, des enregistrements électromyographiques ont été faits pour déterminer l'importance et la direction de la dite prédominance dans la relation fléchisseur-extenseur. Chez trois sur quatre des patients, les enregistrements précédant la stimulation ont révélé la prédominance du groupe fléchisseur, avec légère prédominance des extenseurs chez le quatrième sujet. Dans les quatre cas un énoncé sur magnétophone disant que le bras droit devenait en extension a été répété au patient.

Les résultats ont démontré dans les quatre cas la prédominance des extenseurs, de signification statistique.

Le présent travail favorise la conclusion que les effets positifs de la stimulation verbale répétée n'étaient pas dus simplement à la contraction volontaire ou à la posture. L'apport des présents résultats semble pertinent en relation aux problèmes de médecine psychosomatique.